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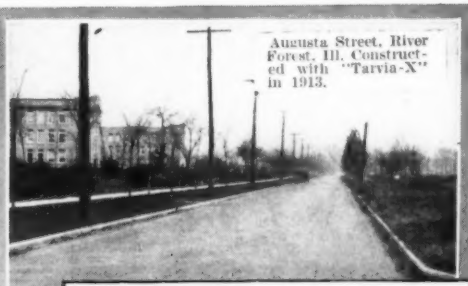
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CITY COUNTY STATE

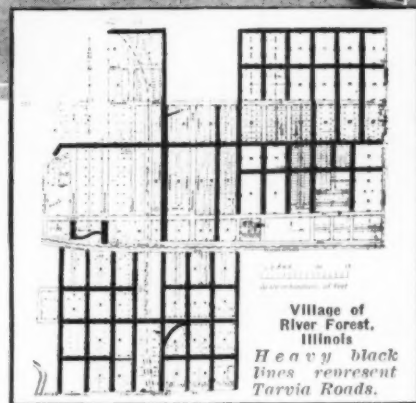
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Oak Ave., River Forest, Ill.
Waterbound macadam, maintained with Tarvia.



Augusta Street, River Forest, Ill. Constructed with "Tarvia-X" in 1913.



Village of River Forest, Illinois
Heavy black lines represent Tarvia Roads.

The Best Streets in the Country—

IN 1912 the Village of River Forest, Cook County, Ill., began using Tarvia for constructing and maintaining its streets. This is the same county in which Chicago is located.

After seven years of experience with Tarvia, and with Barrett service, Mr. Arthur S. Hatch, Village Clerk, writes us this letter:

"I wish to express to The Barrett Company my appreciation for the excellent services rendered the Village of River Forest, both as to the Tarvia furnished and the satisfactory application of same to our pavements.

"As you know, nearly every macadam street in our village is treated with Tarvia, and we believe that we have the best streets of any city, town or village in Cook County."

It is one thing for a community to use a road material occasionally for some special purpose. But it is quite another thing—and very much more of a proof of the

Illustrated booklet telling about the various Tarvia treatments, free on request. Address nearest office.

Tarvia

Preserves Roads—Prevents Dust

material's worth—to have the community adopt that material and use it in increasing quantities season after season, as River Forest has done with Tarvia.

The black lines on the map are most effective proof that River Forest's village authorities and taxpayers alike are strong for Tarvia. Tarvia gives them mudless, dustless, automobile-proof roads at low cost, and after all, that is what every community is looking for, isn't it?

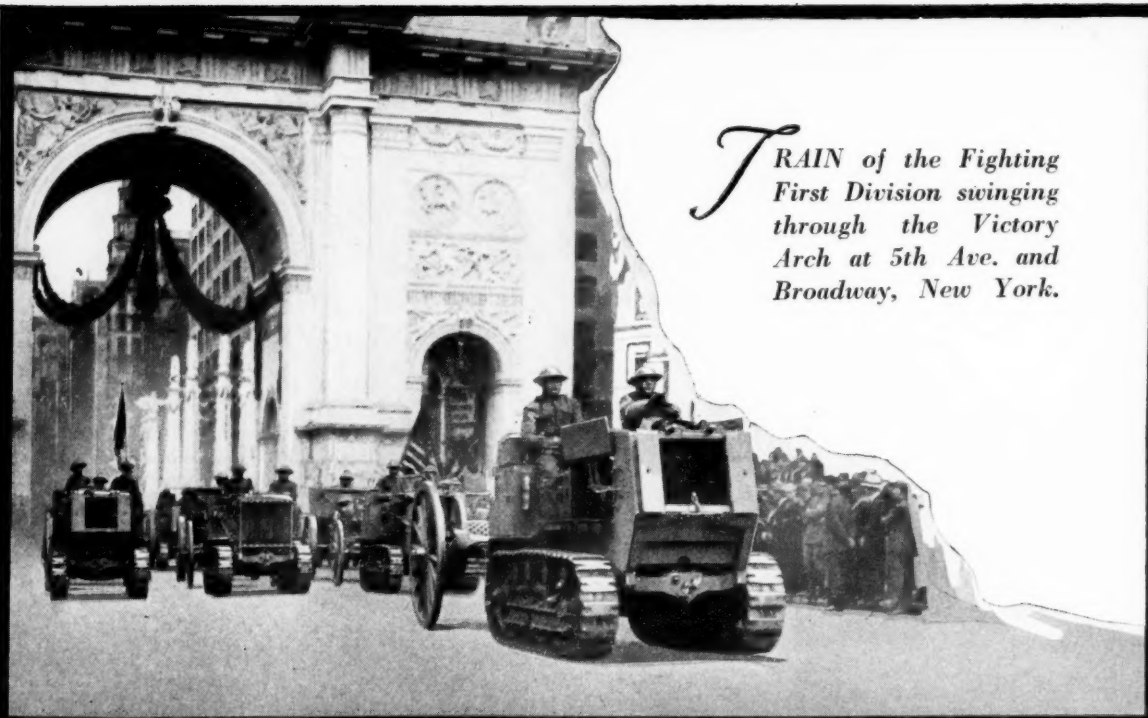
Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems. The advice of these men may be had for the asking by any one interested. If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will be given prompt attention.

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NEW YORK, MAY 8, 1920

PUBLIC WORKS



*T*RAIN of the Fighting First Division swinging through the Victory Arch at 5th Ave. and Broadway, New York.

Streets That Stand the Grind of Traffic

Fifth Avenue—whose surface withstands the grinding wear of New York's concentrated and varied traffic—over which innumerable historic parades of infantry and artillery, tractors, tanks and trucks have passed without injury to the street surface—is asphalt paved.

More than two-thirds of all the modern paved streets in the six largest municipalities of this country are of asphalt.

These asphalt surfaces seldom cost the community anything for maintenance during the first five years. State and country roads can be built to the same standards that assure permanently good traffic conditions at a cost that is not prohibitive.

Our engineering department has compiled illuminating monographs on the cost, building, maintenance and repair of streets and highways. They should be in every engineer's files.

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A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"

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No. 17

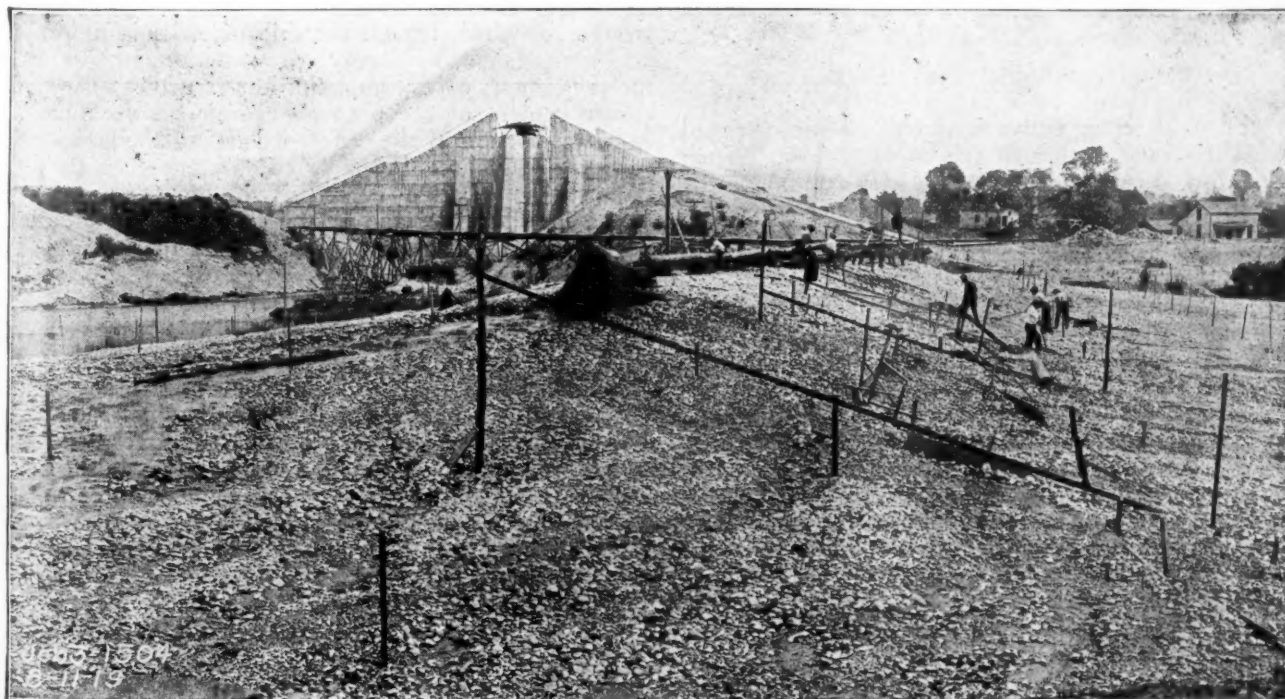
Hydraulic Fill Dams for Miami Conservancy District

Five earth dams in the \$25,000,000 improvement are being made with core embankments built up between side slopes enclosed by parallel levees, all made of materials excavated by dragline machines, hauled in dump cars, pumped to site and deposited by hydraulic operations. Great progress in design, methods and plant secure advanced methods of construction, remarkable for rapidity and economy.

A general description of the work being done by the Miami Conservancy District and the reason therefor was given in the February 14 issue of *Public Works*, and in that of February 21 was described the use of drag-line excavators in removing rock excavation. In this article will be de-

scribed the construction of the five dams by the hydraulic fill method. The work is under the direction of Arthur E. Morgan, chief engineer, Charles H. Paul, assistant engineer, and C. H. Locher, construction manager.

At first the project was classified and divided into



BUILDING THE SOUTH BEACH AND DAM SLOPE, LOCKINGTON DAM.

The slanting boards indicate the finished slope of the dam embankment, the men raking and shovelling the sand and gravel flush with the lower edges. The embankment will be carried up to the top of the wall seen in the background.

about 100 principal contracts, but on account of war conditions and the state of the labor and material markets and for other reasons, few satisfactory bids were received and most of the work has been done by district forces with a very carefully designed system of standard and specially selected mechanical equipment, mostly electrical, which has involved the expenditure of over \$2,000,000, exclusive of materials, supplies and the construction of numerous camps for the accommodation of workmen in places remote from large cities.

MAGNITUDE AND CHARACTER OF DAMS.

The five dams involve for their construction 12,000,000 yards of earth excavation and 200,000 yards of concreting. The Englewood dam is the largest, with a length of 4,660 feet, a height of 108 feet from bed of river to crest of spillway, and a volume of 4,000,000 yards of earth and 38,000 yards of concrete. The smallest dam is that at Germantown, which has a volume of only 865,000 yards of earth.

Each dam extends across the full width of its valley, is built on the prepared surface of the ground, and consists of wide embankments of selected materials with flat paved slopes of 2, 2½, 3 and 4 on 1, counting from top to bottom, and separated with berms and drainage ditches and 10 on 1 apron slopes at the toes.

The center part of the dam is an impervious core of fine material solidly packed and extended down into a core trench of sufficient depth to insure against seepage and undermining. This longitudinal core is supported on both sides by shoulders of sand and gravel, making a stable gravity section. The shoulders on both up and downstream faces of the dam are well covered with a thick layer of coarse gravel and boulders equivalent to a heavy pavement covered with top soil. The crest of the dam is occupied by reinforced concrete roadways 25 feet wide reaching across the valley from side to side.

The concrete conduits, some of which are open canals and some of which are covered, making them essentially culverts, have an unrestricted capacity equal to that of the stream below. When this flow is exceeded the water backs up above the dam until the quantity impounded is 40 per cent greater than that of the 1913 flood, when it can safely escape over concrete spillways.

GENERAL CONSTRUCTION FEATURES.

The hydraulic fill method in its simplest form consists in the use of pumps for lifting, conveying and depositing solid matter suspended in water. This is frequently accomplished by suction dredges which excavate soft bottom and discharge through long pipes to fill in adjacent low ground. In the west, where heavy hydraulic pressure is frequently used, powerful jets are employed to wash down and undermine earth, gravel and other materials and to wash them into sluices, flumes or pipes through which they are transported by gravity to the required position and there deposited by the water flowing over the surface of the fill.

In the Miami dam construction these methods have been combined, modified and supplemented by other features, and have been developed in a rational manner to utilize different standard and

special equipment for the construction of an improved type of dam with the maximum utilization of local conditions and materials.

The principal operations are the preparation of the foundation and the cut-off trench; the building of the upstream and downstream faces or slopes of the dam of boulders, coarse materials and sand and gravel used to form successive tiers of levees; the simultaneous construction, at a fixed rate behind the levee construction, of flat inner slopes of sand and gravel forming the thick sides of a full-length longitudinal settling trough or pool, built up in horizontal layers corresponding to those of the outer levees; and the construction, submerged in the pool, also in successive and simultaneous horizontal layers, of the impervious center core that fills the trough and forms the heart of the dam.

All of the materials for the embankment are provided by mechanical excavation at borrow pits, usually by drag-line machines, delivered to dump cars, hauled by locomotives and emptied into special sumps where they are more or less mixed and controlled and whence they are pumped by powerful centrifugal dredge machines which deliver them a maximum distance of several thousand feet horizontally and a few hundred feet vertically, to the required position at the dam site. Here, by proper manipulations, the water, discharging into the interior trough, automatically separates the classified material and deposits it as required to make the outer slopes, the shoulders and the core, which are deposited in uniform layers from end to end across the valley and back again until the dam is built to the required height. The outer slopes, requiring some hand and machine work, are built first and are rapidly constructed, subsequently the material deposited next to them by hydraulic action rapidly fills up the shoulders by forming "Beaches," which are the sides of the trough, in which trough the fine material is more slowly deposited, wholly by sedimentation, to form the impervious core, completing the structure. Accurate control of the process, definite results and exact proportion of the different parts of the cross-section are secured by experienced control of the pumps, the relative elevations of delivery and outlet for the water and by the character and proportions of the materials secured from the borrow pits.

PRELIMINARY OPERATIONS.

The clearing and grubbing of the site is followed by the removal of the top soil with ploughs, wheeled scrapers, dump wagons, and elevating graders. The earth thus removed is deposited in spoil banks beyond the upstream and downstream toes, and stored for use as a top dressing on the finished slopes.

After the site has been stripped, a cut-off trench about 30 feet deep and 50 feet wide is excavated from end to end of the axis of the dam by a drag-line machine. Steel sheeting to cut off leaks is driven when necessary and the trench is filled with puddled clay.

Wherever necessary, by-passes are excavated to carry the stream flow across the dam until the permanent concrete conduits have been constructed, and the materials derived from these excavations,

from borrow pits or from any other suitable source, are used for the construction, by hand or by machines, of levees from 4 to 8 feet high parallel with the axis of the dam, which are located at the up and down-stream toes of the embankment and reach across the valley from side to side, enclosing between them and the side slopes of the valley a rectangular area embracing the whole foundation of the dam.

Adjacent to these levees and a little beyond them is excavated, on each side of the large dams, a sump, called a "hog box," usually from 10 to 20 feet wide and deep and about 100 feet long, with the sides sheeted or braced if necessary.

As the spoil banks are built up, they are continuously washed down into the sumps by powerful hydraulic jets from monitors, which are very carefully manipulated to provide to the pump suction a constant supply and of as uniform a character as possible.

ENGLEWOOD EXCAVATION.

Although the details of excavation and transportation of the dam material vary at the different sites, the general features correspond and a good idea is given by the conditions existing at Englewood, where the 4,000,000 yards of earth for the embankment is excavated from an area on both sides of the river a little more than a mile long and a mile wide, which is adjacent to the dam on the upstream side.

This excavation is done by two 115-ton drag-line machines with 85-foot booms and $1\frac{1}{2}$ -yard buckets,

which are installed about 1,000 feet apart on the same track. One of the machines, operated by electricity at 1.06c. per kilowatt hour, is a little slower than the steam machine but is somewhat less expensive on account of the high cost of coal-ing. The machines work on a face about 15 feet high and each, during a 10-hour shift, delivers from 150 to 180 cubic yards of earth, sand and gravel to the 12-yard air dump cars operating on a double-track system with cross-overs arranged for continuous movement of the cars without waiting.

The cars are run in four 7-car trains, each hauled by a 40-ton locomotive and up a 2 per cent grade to a dumping trestle 175 feet long and 13 feet above the floor of the hog box, which slopes about 4 per cent to an opening on the side.

DELIVERING MATERIAL TO THE PUMP SUCTION.

From the dump the material is sluiced into the hog box by a 60-pound hydraulic jet from the 3-inch nozzle of a monitor, the water for which is supplied by two 10-inch centrifugal pumps making 1,760 r. p. m. and each driven by a 100 horse-power motor.

The two monitors wash the materials to the opening in the floor of the hog box, through which it is discharged into revolving steel screens 4 feet in diameter and 9 feet long pierced with 6-inch and with $6\frac{1}{2}$ inch holes through which the material passes to the 8x16 foot concrete sump having two 8x8-foot chambers with their bottoms 16 feet below the hog box. The axes of the screens are inclined 1:24 from the horizontal and are driven by $7\frac{1}{2}$ h. p. electric motors at 9 and 14 r. p. m.



BEACH AND SLOPE AT EDGE OF POOL, ENGLEWOOD DAM.

Shows the sharp drop in the slope of the sand and gravel at the edge of the pool, which is normally at the top of the steep slope in the foreground, the pool water having been drawn down about 2 feet.

The materials rejected by the screens pass out of their lower ends and are loaded by derricks into cars, in which they are hauled to the downstream slope of the dam, where they are built into the levees. The material passing to the sump is used for the hydraulic fill. The revolving screens serve a double purpose, that of removing over-size stones, and that of regulating the feet to the suction so as to produce a uniform flow, which it was found impossible to accomplish without them when the material was moved up to the sump by the action of the hydraulic monitors alone. No matter how skillfully the monitors were handled, they would sometimes deliver almost clear water and at other times would deliver too large masses of solid material, thus making the action of the pumps very irregular and expensive and increasing the danger of the discharge pipe being plugged.

Under each screen is a hopper receiving the accepted material and mixing it as it passes to the suctions of the two 15-inch centrifugal pumps, each operated at 505 revolutions per minute by a direct-connected 500 h. p. variable slip-ring induction motor capable of delivering the flow at an elevation of 150 feet above the pumps. The pumps are provided with runners 38 inches to 46 inches in diameter to correspond with the different heads of 25 feet to 150 feet to which the effluent is raised.

Although made of manganese steel, the life of these pumps, when handling sand and gravel, is a little less than 200,000 cubic yards. The impellers show wear at 50,000 cubic yards but can be used to a maximum of about 100,000 cubic yards.

The dredge and monitor pumps together require about 31 cubic feet of water per second, which is derived by gravity from the river through a 4-ft. corrugated iron culvert. Each monitor uses about 2,000 gallons per minute and each dredge pumps about 7,000 gallons per minute.

PIPE LINE.

The dredge pumps discharge through a line of 15-inch cast-iron flanged pipe extending to the foot of the dam and remaining permanently in position. From the end of the cast-iron pipe, the discharge is continued through a movable extension of the line made up of light pieces, easily attached, detached and handled. At first these pipes were made of ordinary riveted steel construction, but this proved very short lived, and was later replaced by specially manufactured high-carbon-manganese steel 11-64 inch thick and weighing 28.83 pounds per linear foot. The pipes are made in 16-foot lengths with telescopic joints held in position with wire lashings around lugs on the ends of the welded pipe.

As it has been observed that all of the solids carried by the water are located in the lower third of the pipe, the circumference of the pipe is divided into three equal portions numbered at the ends, 1, 2, and 3, and whenever the pipe is shifted, care is taken to turn all of the sections uniformly 120 degrees in the same direction, thus insuring equal wear over the entire surface of the pipe, which so far has passed 300,000 yards of earth, sand and gravel without showing signs of failure.

EFFICIENCY OF PUMPING.

The greatest efficiency and economy of pumping

is, of course, attained when the pumps work uniformly and continuously at full capacity. If too little solid matter is carried in suspension, money and time are of course wasted, and although the pumps can carry an overload for a short time, if it is long continued the pipe is inevitably plugged and much time, expense and discomfort are necessary to clean it out. Thorough co-ordination is therefore required between the monitor men at the hog box and the pump runner, and if the latter does not increase the power simultaneously and correspondingly when the material is crowded by the monitor, trouble is certain to result.

At first a control tower was built overlooking the hog box and in it were installed pressure and vacuum gages, electric bell connections to pump men and monitor men and connections with telephones at the ends of the pipe lines, thus enabling the signal man to direct the monitor men and the pump men; but it was found that the gages did not always operate as positively or as rapidly as necessary and the line would sometimes become plugged without warning.

As the first indication of plugging has been observed to be a decrease in the discharge at the end of the pipe, a float at that point is now arranged to maintain an electric contact when the discharge is maximum and any diminution of discharge breaks the contact and signals through electric lamps at each monitor and at the pump, thus enabling the proper steps to be taken instantly to prevent the plugging. The operation of this device has considerably increased the output and reduced the difficulty from plugging.

The percentage of solid matter handled by the pump varies up to 20 per cent of the volume of water, with a present average between 6 and 10 per cent. Where the material is of a clayey nature as at Taylorville, with a discharge velocity of 12 feet per second the frictional loss of head is about 4 feet in 100 linear feet, but in gritty sands and gravels at Englewood and Germantown, with velocities of 12 feet and upwards the friction head amounts to as much as 8 feet per 100.

At Englewood, the monthly delivery of two 15-inch dredge pumps, each working two 10-hour shifts a day, averaged 85,000 yards until changes and improvements in the screens and sumps increased it last fall to 150 yards per hour for each pump or 6,000 yards per day.

(To be concluded)

Virginia Issues Engineers' Certificates

The engineers' license bill has been passed by the Virginia legislature, signed by the governor and is now a law. It provides for the issuing of certificates to practice under the title of certified professional engineer, or certified architect, or certified land surveyor.

The examining board is composed of three architects, three professional engineers and three land surveyors, with at least ten years' engineering experience. Certificates are granted upon evidence that the applicant has practiced engineering or architecture for not less than six years or land surveying for not less than two years. The fee is \$5.00.

Any citizen in the United States or any citizen-declarant of twenty-one years of age, of good character with at least four years' experience in engineering or architecture, or two years' experience in land surveying, or who is a graduate in architecture or engineering may be granted a certificate after satisfactorily passing the examination, in such professional subjects as may be prescribed by the board. The bill provides for reciprocity with other states whose requirements are satisfactory to the board.

Rainfall Records at Hartford

Continuous records of from seven years to sixty years' duration contain data tending to show that the precipitation of three to six months only determines whether that for the year is excessive or deficient.

The annual report of the Board of Water Commissioners of Hartford, Conn., for the year ending March 1, 1919, contains rainfall records on the several water-sheds of the water department, one of them running back 60 years, another 51 years and three others for seven years. These show the rainfall for each month of the year 1918, of the year of maximum rainfall, of minimum rainfall and the average rainfall for each of the months. They show some interesting facts concerning years of exceptional rainfall which, while not developing any new ideas, are interesting as supplementing other similar records.

One of the most striking features about these figures is that it is the rainfall of two, three or four months of a year which determines whether it is a year of maximum or of minimum rainfall. For instance, taking the 51-year record at West Hartford reservoir, we find that during the year of maximum rainfall the monthly rainfall was less than the monthly average for the 51 years during 6 months, namely January, February, June, July, October and November. The great excess occurred in the months of March, April, May and December. On the other hand, during the year of minimum rainfall, the monthly rainfall during February and October was greater than the average.

Taking the 60-year record, we find in the same way that during the maximum year the monthly rainfall was less than the average for that month during January, April, July and August, while the months of heavier rainfall were May, June and October. It will be noted that two of these months of excessive rainfall were the same as those of deficient rainfall during the maximum year of the other record, while one of the months of deficient rainfall of the 60-year record was a month of maximum rainfall of the 51-year record. In this series of records, also, the minimum year contained three months during which the rainfall ex-

ceeded the monthly average, these being August, September and November. Incidentally, this record contains the only month of absolute lack of precipitation shown in any of the eight records given, this being in January.

The seven-year records show similar peculiarities. One of these is that on the Nepaug basin, the year of minimum rainfall having a rainfall of 4.65 inches in March, while during the same month in the year of maximum rainfall the precipitation was only 0.06; and for April the minimum year gave a rainfall of 4.42 inches and the maximum year only 2.07 inches. June and October also showed the record of the minimum year exceeding that of the maximum year, although by considerably less amounts. In fact, six of the twelve months show higher monthly rainfall during the minimum year than during corresponding months of the maximum year.

The conclusion suggested (although, of course, by no means proved) by these figures is that annual records of excessive or deficient rainfall are occasioned by unusual precipitation during only three to six months of the year and not by conditions continuing throughout the year.

Cleaning New York Streets

Recommendation of use of alternate machine sweeping and flushing, and use of motor equipment for snow removal.

Methods and equipment, and their efficiency, for removing snow, ashes and garbage from the streets of New York are discussed in the April 12 issue of a leaflet entitled "Women and the City's Work" which is published by the Women's Municipal League of the city of New York. This recommends that the system of former street cleaning commissioner Fetherston, namely, cleaning the streets with sweeping machines one night and flushing them the next night, be extended to cover the entire city and that the sweeping machines be followed up by vacuum cleaners instead of by hand work. This system to be maintained during nine months in the year, omitting the flushing in freezing weather.

The snowfalls should be swept up and brushed to the center of the road bed and then handled by automobile machines making one trip down the center of the street, elevating the material and loading it into trucks, thus greatly expediting the work and diminishing the number of men required. It is recommended that the snow removing machine should also be equipped with a vacuum cleaner to carry the dirt up into the hopper at the top and empty it, so that it may be used in the summer for handling dirt, ashes and garbage, which should be emptied into the same trucks used for transporting snow in winter. These snow trucks would only

need the addition of a cover to prevent the ashes from blowing away.

These machines should be motor drawn and should be stored in garages so as to protect them from the weather to which, at the present time, the street cleaning machinery is said to be exposed. The Board of Estimate and Apportionment is therefore petitioned to immediately appropriate money for building garages and shelters throughout the city to house the automobile trucks and machines.

The statement is made that a year ago when the city forces were used to dispose of ashes for filling in at Rikers Island, they were able to dispose

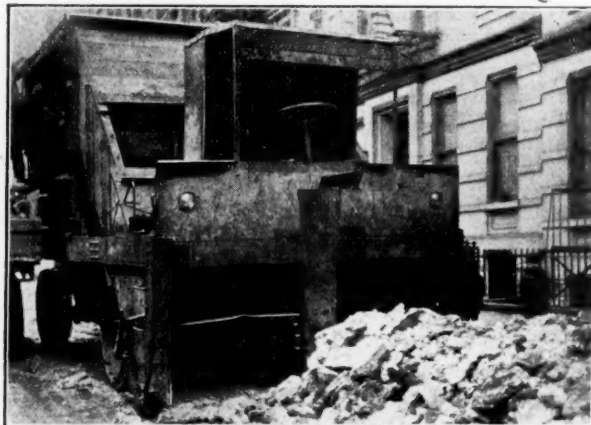
of only four scow loads per day, while the contractor who afterwards undertook this work disposed of eight scow loads per day. The contract, however, expired on the first of April and the city will be obliged either to buy additional equipment or find some other disposition for the ashes which can well be applied to filling in many marshy places in and around New York which can be reclaimed for business purposes and dwellings.

It is represented that the removal of New York garbage is even less satisfactory than the ash removal; that the garbage is sometimes mixed with ashes which, when used in fill, constitute a menace to public health, and it is suggested that the garbage disposal plant now installed on Staten Island be removed and used to equip several small plants in the different boroughs, thus eliminating expensive long hauls and reclaiming by-products, besides dispensing with the private ash collectors, to whom no future licenses should be issued.

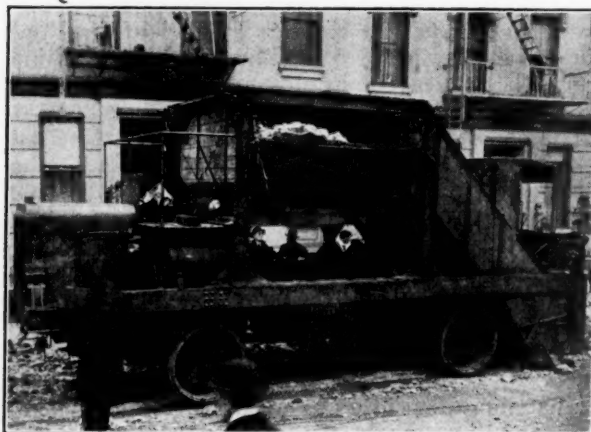
It is stated that the cost of handling snow in New York streets last winter was \$6,000,000, a large portion of which could be saved by the operation of an adequate system of snow-handling machinery, the installation of which could be largely provided for by this economy, to say nothing of the immense losses that the heavy snowfall and its slow removal have occasioned by damage to automobiles and trucks and the loss of perishable freight which could not be delivered on account of the conditions of the streets.



TANK MACHINE ELEVATING AND LOADING SNOW.



DUPLEX ELEVATOR SHOVELS OF TANK MACHINE.



SNOW TANK MACHINE IN NEW YORK STREET.

Mechanical Snow and Ice Removal

During last winter successful demonstrations were made in the streets of New York City, of the operation, by two men, of a machine handling snow at the rate of 50 cubic yards per minute or ice at the rate of 25 yards per minute, clearing a path 9½ feet wide at the rate of 8 miles per hour for a six-inch snowfall and delivering the snow or ice continuously to trucks or cars alongside or depositing it in piles, thus eliminating a large amount of hand labor and providing for a rapid opening of street for traffic obstructed by snow.

The machine, called a Friedman snow tank, is 26 feet long, 9½ feet wide and 12½ feet high, weighing 22 tons. It has a steel frame tank mounted on a Christie four-wheel drive truck with a special frame. Over the rear wheels of the truck is mounted a 150 h. p. 6 cylinder Sterling marine engine 5½-inch bore and 6¾-inch stroke which is started electrically from the rear platform. This engine operates an inclined conveyor having two parallel sets of steel buckets with heavy cutting edges mounted on endless chains and acting as shovels that cut and scoop up the snow and ice and elevate them, in a closed box, to the receiving hopper as the machine advances under its own power like an ordinary automobile truck. The contents of the hopper can be discharged continuously, clear of one side of the machine by a transverse conveyor thus forming a bank alongside the cleared

space, or it can be discharged intermittently by opening the side door in the hopper and operating a lever that empties the contents in a separate heap on the ground or delivers it to the car or truck alongside. When not excavating, the machine has a maximum speed of 10 miles per hour, with four speeds ahead and one speed reverse. It can excavate at the rate of 8 miles per hour in snow 6 inches deep to 2 miles an hour in snow 24 inches deep, loading flat cars at the rate of 25 to 50 yards per hour according to the consistency of the material handled. An 8-yard truck can be loaded in from 1 to 1½ minutes.

The machine can be operated continuously day and night except for a reasonable allowance of say 2 hours per diem for oiling, cleaning, fuel supply, change of shifts, etc., thus affording 22 working hours in which time it is capable of loading 1,300 8-yard trucks. It is operated by two men, the truck driver and the mechanic who stands on the rear platform and operates the motor underneath and the levers controlling the loading slide. In a speed demonstration, held Friday, March 19, for the New York City authorities, four 5-ton trucks were filled with ice in less than 3 minutes.

Allowing an extra man, three in all, for the opera-

tion of the machine and assuming it to require 5 gallons of gas and oil per hour with \$25 per day for wear and tear and \$50 per day for overhead, the total cost of excavating and loading at the rate of one truck load per minute is \$0.20 as compared with \$2.66 for loading with an 8-men gang in 20 minutes. Adding to this \$1 for the average cost of an auto truck carting the snow and returning in 15 minutes, the cost of the machine work is \$1.20 and by hand is \$3.66. The total cost to the city allowing for expansion of snow in the trucks, and for piling, loading and carting, is estimated at \$6.12 for 8 cubic yards for hand work while the corresponding cost for machine work is only 64 cents, thus effecting, according to the promoter's figures, a saving of \$5.48 for large truck loads or about \$0.68 per yard of snow and ice. They also estimate that a fleet of 50 of these machines would clean the streets of New York in from one to three days, depending on the size of the snow-fall, provided sufficient facilities were furnished for removing the snow which would require a large number of automobile trucks systematically operated to be in constant attendance on each machine and to move uninterrupted back and forth between it and the dumping grounds.

The Alien Labor Supply

Immigration in 1919 was less than one-seventh what it was in 1913, while emigration has greatly increased. The shortage is especially felt in the necessary uses of common and farm labor. Abundance of such labor will probably come if not discouraged.

For the last few years the United States has been depending to an increasing extent on aliens for a large proportion of its labor, amounting, for unskilled work, to nearly the whole supply and to half or more for many important branches of skilled work such as steel making, carpenters, masons and the like. The supply was not only greatly diminished, and in some cases almost entirely cut off, by the breaking out of the war, but many of the aliens already here left their occupations to return at the earliest moment for war service in their native country.

As shown by the accompanying table prepared from the United States Records, immigration was less than 15 per cent as much in 1919 as it was in 1913, while emigration in 1918 was more than 316 per cent of what it was in 1913, and in December, 1919, the arrival of aliens was only about 40 per cent of what it was in December, 1913:

About 85 per cent of the immigrants to this country arrive at the port of New York, where at the present time it is estimated about 80 per cent of them are reservists, that is, men of military age that are required to respond on call to the demands of their native country for military service.

Total Number of Steerage Aliens, Including Women and Children, Entering and Leaving United States from 1913-1918.

Year	Immigrants	Emigrants
1913	1,142,227	611,924
1914	1,403,081	633,805
1915	434,244	384,174
1916	366,748	240,807
1917	362,877	146,374
1918	211,853	193,268

Alien Arrivals in 1919.

Month	Immigrants
January	2,589
February	2,975
March	5,850
April	11,355
May	7,462
June	9,485
July	9,439
August	9,430
September	20,577
October	24,641
November	17,557
December	34,529
December, 1913	78,977

Among the different nations represented in the arrivals, the Italians predominate, and after them Poles and Czecho-Slavs. It is reported that at least 100,000 Italians are awaiting an opportunity

to emigrate to this country and that large numbers of citizens of other European countries would gladly come here were it not for restrictions that they cannot overcome. Official admissions have not been made that they are subject to government restrictions, but there is good reason to believe that if passports, and their visé by American officials, were easy and simple to get and transportation was abundant, very large quantities of laborers would pour into this country and most of them would be desirable additions for our industrial work.

Classified statistics of the proportion of able-bodied male laborers to the total number of immigrants or of the work for which they are qualified or of their distribution in this country are not accessible, if indeed they exist, but it is in general true that they pass through the ports of entry in groups as arranged for by European agents and bound for more or less remote localities or that they come to join friends and relatives already settled all over the country. There is no clearing house for the classification and distribution of foreign labor and it is not under much rational direction.

Careful observation of the arrivals at Ellis Island indicates that a very large percentage of them are desirable laborers and that the proportion of anarchists, bolshevists and other dangerous radicals is small and would be much less mischievous if promptly dealt with in accordance with their actions and deprived of all newspaper publicity. After the arrival of immigrants in this country, it is difficult to commence investigations concerning them, which should be carefully attended to by qualified officials in their home countries, which should rigidly exclude undesirables.

Conditions in European countries are and will be so difficult that there will be an enormous number of emigrants ready to come here as soon as they are able to do so and as long as attractive conditions exist in this country.

It is significant, also, that the shortage of both foreign and native labor is most severely felt in work connected with the necessities of life, while the manufacturers of luxuries, mostly requiring lighter and pleasanter work, have abundance of labor to whom they practically pay any price demanded and simply charge the excess to the public, which in this era of extravagance pays most exorbitantly without protest. This condition may be overcome in a measure by making conditions of work more attractive and by employing a higher class of labor.

Advertising for Labor

The scarcity of labor and the failure of adequate supply from ordinary channels has caused some large employers to make special efforts through recruiting officials and public advertisements. The latter usually appear in local papers published in districts where there is reason to look for an excess of men, a scarcity of employment or an unbalanced condition. This practice has been extended in a recent case to the publication, in a technical paper principally read by employers, dealers and officials rather than by individual workmen, of a conspicuous announcement giving par-

ticulars of the job, conditions of work and provisions for the welfare of the men, which are naturally made as attractive as possible with an appeal for more than 300 skilled workmen on a 5-year contract at wages ranging from 50 to 75 cents per hour.

The advertisement describes the housing conditions offered, including a private room with single beds and 400 cubic feet of air space for each man, a recreation room for every 28 men, improved sanitary arrangement and high-class board and lodging at a cost of not more than \$7 per week. One thousand men will be needed to complete the job.

Massachusetts Educating Immigrants

The Intelligence Department of the State of Massachusetts has commenced an active campaign among industrial workers with a view to inspiring patriotism and loyalty and educating foreigners in political and industrial matters. Little books are to be issued giving alphabetical and geographical lists of the industries of the state, together with information concerning the cities and towns where they are located and explaining their educational and recreational advantages and other attractions. They will also give descriptions of the holidays and of their meaning, an example of which is afforded by the reference to April 19, 1775, the anniversary of which has been set apart to commemorate the first battle of a nation determined to be governed by law instead of the arbitrary will of a despot, since when America has always stood for law and for order under the rule of a government chosen by the people themselves with no distinction of class, wealth or creed.

Decisions of National War Labor Board

In the case of the Pacific Electric Railway Company, Los Angeles, California, the National War Labor Board finds that the employees' individual discussion of grievances without a system of collective bargaining is inadequate and recommends that the employees be given the right to meet and treat, through their own committees, with the officials of the company in regard to wages, working conditions and other matters and that these committees should be recognized regardless of the fact that the individuals are members of the union. This does not, however, imply that the company deals with or recognizes the union but merely that it deals with the committees of employees and not with the union.

In the case of individual workers at Lancaster, Pennsylvania, the board rules that because of depression, hours should be reduced before men are laid off.

In the case of the Schuylkill Railway Company and its employees, the Board rules that the contract fixing the wages until a specified future date could not be annulled without the consent of the employers.

In another case it denied an advance of wages to teamsters in Lynn, Massachusetts, on the ground that there had not been a material change in the cost of living since the agreement last made and that what change is now taking place is rather in the direction of lower prices.

Labor Notes

Some recent happenings and reports which have a bearing upon the subject of the labor supply available in the United States.

The number of employes in New York State factories in July, 1918, was 25 per cent, and in February, 1919, was 11 per cent more than in June, 1918.

Legislation is proposed in Sweden to standardize an 8-hour working day for all classes of labor. Manufacturers claim that with present wages this will make production impossible and shoe manufacturers have already decided to close down plants and it is anticipated that hundreds of the thousands of workmen may be thrown out of employment if the law is passed.

The Trades Hall Council of Melbourne is agitating for the adoption of a 40-hour week for all workers in all industries in Australia.

It is reported that five meat packing companies of Chicago have given a pledge to Secretary of Labor Wilson that they will make no wage reduction for at least one year after the signing of peace, and that they will guarantee a 44-hour week with time-and-a-half for work over 8 hours and double time for Sundays and holidays, the present wage scale running from 46½ cents per hour for common labor to \$1.25 for skilled labor.

A plan has been adopted at the Standard Steel Car Works, Hammon, Indiana, whereby workmen committees, in conference with the owners' committees, will take up the subjects of shop methods and economy, employment and working conditions, housing and living conditions, athletics, recreation and education.

American Inland Waterways

Speakers at the convention of the Mississippi Valley Waterways Association at St. Louis urged that the country develop its inland waterways transportation in order to retain its position in the world of commerce.

James E. Smith, president of the association, compared America with Europe fifty years ago when that continent discovered the necessity of using waterways as carriers and built artificial channels. He declared that America had the natural channels but did not appreciate their value.

Brigadier General Hines, chief of transportation of the War Department, said that the railroads welcomed the revival of water transportation as "a necessary ally in the solution of transportation problems." He further stated that the War Department desired to become a material factor in assisting waterways to assume a considerable por-

tion of the transportation problems and cited the operation of several barge services already initiated as a single but vital phase of this undertaking.

Surveys are now being made for a 59 mile canal from Jatineo, Glenn County, to Williams Road, Colusa County, California, for the irrigation of 250,000 acres of rice lands. Plans are to be filed with the State Reclamation Board and it is intended to execute the work as rapidly as possible.

The Transportation Situation

At the luncheon meeting of Members' Council of the Merchants' Association of New York, held April 19, the transportation situation was discussed before more than 1,000 members and guests largely representing important business interests. In discussing transportation conditions and their influence on general business, A. H. Smith, president of the New York Central lines, said, regarding the "outlaw" strike, that it is a proof of morale because of the loyalty of the majority of railroad employes, who are fundamentally sound and are proving their worth as good Americans despite the disturbances of the few hotheads that have gotten away, and that we should take courage and hope from the present experiences.

Mr. Smith referred to the tremendous handicap placed on the railroads by legislating an enormous increase of payroll without permitting an increase of rates, and to the depreciation and shortage of equipment during government control, notwithstanding which the Central Railroad has just authorized the purchase of \$50,000,000 worth of new equipment on account of the 10,000 passenger cars and 2,000 locomotives now lacking. He stated that the railroad situation on Manhattan Island is practically what it was 30 years ago and that at least \$200,000 a day is wasted there in distribution. He also stated that the average cost of all the railroads in the United States, including their equipment, is only \$72,000 a mile, while a highway across the state of New York cost \$36,000 per mile.

George C. Taylor, president of the American Railway Express Company (the new corporation which purchased the property of the Adams, American, Southern, and Wells Fargo Express Companies), stated that they have operated for 22 months without any return for the \$35,000,000 value of their real estate and plant and with a deficit of more than \$33,000,000, and said that their efforts are now centered on giving better service by the use of the most direct routes, avoiding duplicate service and expense, avoiding delay and damage by rehandling at junction points and transfers, and competing fairly with parcel post, normal freight service and trucking service. The organization of more than 135,000 people in 35,000 offices has an annual turnover of about \$300,000,000 of charges and asks only for a fighting chance to give

efficient, cooperative and dependable fast transportation service.

The veteran railroader, Chauncey M. Depew, said that for the first time in fifty years the public is beginning to look at the railways as a partner with whom there should be no controversy. Referring to the relations between railroads and labor unions, Mr. Depew said: "I have been dealing with unions all my life. I never had any trouble with them. I believe in them. You can get down to a fair, square, man-to-man talk with them, as to what is needed on the one side, on the other, and on all sides. But there is one thing that must not be forgotten, and that is that no section, no class, no occupation, should be able to prevent the people in other occupations from exercising their functions; and the only way to stop that is to have a new union, a new union of the middle-class men of this country and the middle class women of this country, who constitute eighty or ninety per cent of our population, and let them form a union which shall declare that all classes must be treated fairly, squarely, rightly, justly and righteously!"

Tunnels and Canals

An unsuccessful effort was recently made by Senators Edge and Calder, of New York, to have Congress include in the Urgent Deficiency bill an appropriation of \$100,000 for the federal investigation of methods of ventilating vehicular tunnels to be conducted by the Bureau of Mines and secure information of great value for the solution of the problem of ventilating the proposed New York, New Jersey and other vehicular tunnels and similar projects.

Proposals for bond issues to be submitted to taxpayers of New Jersey this year total \$57,000,000. The items in this proposed bond budget include \$28,000,000 for interstate bridge and tunnel, \$1,000,000 for the trans-state ship canal right of way and \$16,000,000 to provide for the construction and enlargement of institutions.

Frank M. Williams, state engineer of New York, has reported to the Legislature condemning, as unfeasible, the proposed St. Lawrence canal for a direct ship route from the Great Lakes to Europe.

To Dam the Grand Canyon

It is planned to dam the Grand Canyon in order to supply electricity for the entire state of Arizona. The plan, which has just been revealed by Ralph Cameron, builder of the scenic Bright Angel trail, calls for a dam 400 feet high and 600 feet across the top, creating a water head that will distribute 1,000,000 horse-power of electric energy throughout the state. The plan is backed by \$100,000,000 of New York capital.

Power from this source will be delivered to practically every farm, mine and industrial plant in

the state at a price of one cent per kilowatt instead of ten cents as is now the case. The dam, when completed, will impound water sufficient to make a lake 23 miles long.

Hetch-Hetchy Tunnel Contract

On April 27 the city of San Francisco received four bids for the construction of about 16 miles of aqueduct in tunnel through the Sierra Nevada mountains, the lowest bids being \$7,802,952 on the cost-plus-fee basis and about \$10,000,000 on the unit price basis. The lowest bidder was the Construction Company of North America whose fee of \$1,190,329 was based on estimated costs of \$78, \$84 and \$83 per linear foot for the three divisions of the tunnel. The lowest bidder on the unit price basis was R. C. Storrie & Company whose total bid of about \$10,000,000 was based on estimates of \$107, \$105 and \$109 per linear foot for the three divisions.

The city of San Francisco will issue from \$12,000,000 to \$15,000,000 of bonds to pay for the work, and if the contract is awarded on the cost-plus basis, the bonds will be purchased for cash by the banks at par, and out of the contractor's fee the contractor will immediately pay back \$260,000 to the bank, and afterwards three successive payments which together will make up the difference between the market price of the bonds and the par value which the banks advance.

If the contract is awarded on the unit price basis, the contractor himself will accept the bonds at par, assume all costs of construction, and deposit a certified check for 10 per cent of the estimated cost of the work, as guarantee for its satisfactory construction, and will make his profit, if any, on the difference between the selling price of the bonds and the actual cost of the work.

Fellowships in Highway Engineering and Transport

The University of Michigan offers four fellowships during the collegiate year, 1920-1921, as follows:

The Roy D. Chapin fellowship in highway transport, for investigation of an approved subject relative to highway transport.

The Roy D. Chapin fellowship in highway engineering, for investigation of an approved subject relative to hard surfaced roads and pavements.

Two Detroit Edison fellowships in highway engineering, for investigation of approved subjects relative to moderate cost country roads.

Each of these pays \$250 with an allowance of \$50 for expenses. A Fellow must hold a Bachelor's degree from a college of recognized standing, must enroll as a candidate for the degree of Master of Science and be in residence during one of the three periods, October to February, December to March, or February to June. Applications should be sent to Arthur H. Blanchard, Professor of Highway Engineering, University of Michigan, Ann Arbor, Mich., not later than September 1, 1920.

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Heads I Lose; Tails You Win

If the city of San Francisco awards the contract for its 16 miles of tunnel conduits to either of the bids mentioned on page 400, it is bound to pay a sum probably in excess of the reasonable cost-plus profit involved.

Four bids were opened, the lowest one being for cost plus contractor's fee, which throws all of the risk on the city (where indeed it belongs), but receives an exceptionally large contractor's fee which includes the discount on the city bonds sold below par. The other lowest bid, on unit price basis, is about 28 per cent. larger and puts all of the risk and the discount on bonds on the contractor's shoulders. The difference in the two bids is nearly \$2,200,000 and both bids are probably \$1,000,000 or more larger than they would be if the city could sell its bonds at par. Under these circumstances it appears that the city of San Francisco is in a position to wish devoutly for better financing.

Reducing Flood Damages

In accordance with the truth, so often demonstrated, that "hind sight is easier than foresight," the state of Ohio, after suffering an immense loss of life and property from the 1913 flood in the Miami Valley has, by legislative action, authorized the expenditure of a large sum of money to prevent the recurrence of the disaster and has appointed an able corps of directors and engineers to plan and execute, at an estimated cost of approximately \$25,000,000, protection works, which, had they been completed a few years sooner, would doubtless have effected a net saving of about one hundred million dollars in property value alone in 1913.

Belated though the action is, in view of the recent disaster, it is still timely as an indispensable safeguard against future floods which may become more and more violent as agricultural conditions develop. It is also more than doubtful that the scientific and mechanical facilities and experience available would have sufficed for a thoroughly satisfactory treatment of the problem many years prior to the flood.

Notable features of this undertaking are the

thorough investigation, expert tests and experiments that preceded the solution of the problem and influenced the rational decision to oppose the least possible resistance to the great and irregular hydraulic forces and to control and direct them in such a way as to modify their action and guide their operation by the simple expedient of temporarily holding a portion of the flood near its sources and so regulating its flow as to diminish the maximum intensity and protect adjacent property.

This principally involves ordinary river improvements and large earthen dams with concrete appurtenances requiring chiefly local materials and a large equipment of standard heavy construction plant designed to be handled with the minimum operating force. The important structures and building operations are being described by PUBLIC WORKS in a series of articles beginning with the February 14th issue.

This work is worthy of careful attention because it is representative of advanced methods in design and execution of heavy engineering construction that have been developed with special regard to safety, efficiency, rapidity, permanence, and ultimate economy. High ground has been taken in promoting fairness and amicable relations between the owner, the engineer, the contractor, employee and the public. Simplicity and uniformity of design have utilized available supplies and equipment and facilitated the installation of a satisfactory mechanical plant. The specifications have been notably simplified, standardized, and modified and the welfare of the employees has been so successfully promoted as to secure exceptionally abundant and efficient workmen. The selection and distribution of power and the co-ordination of successive operations have reduced the cost of the work, and the adherence to a schedule of operations has proved advantageous.

Increased Immigration Necessary

Increased immigration for this country is not only obviously necessary, but it is reasonable, easy to secure, and will injure neither this country nor the countries from which immigrants come. On the contrary, under proper regulations, it will quickly and directly benefit all those who are concerned.

It is universally known and admitted that throughout the world there are vast deficiencies of food and other necessities which are causing privation and discontent. The United States, which has the largest resources, highest mechanical development and organization and by far the most abundant capital and facilities, must help the world and, so doing, vastly benefit and enrich herself. To effect this requires only a concentration on essential productions rather than on luxuries, and an abundant supply of reliable labor. Nearly all the labor in this country has been educated and specialized until it is largely classified, demands and receives high wages for skilled services, and is inclined to refuse unskilled employment. This is well and good, and there is enough such employ-

ment for all the qualified workers if they can be supplemented by the necessary unskilled laborers. There are unlimited quantities of them in many foreign countries who are anxious to come, and would greatly better their own conditions by working here at rough, unskilled and disagreeable operations for wages that would not be considered by trained American workmen, but yet are adequate for the services rendered. It only remains to secure these men. The only objection to this lies in the unfounded prejudices of the labor trusts, which appear determined to create, by every method, an artificial labor famine to the incalculable damage of the whole nation, themselves included.

We need today 2,000,000 unskilled workers to help raise our crops and build our highways, aiding the mechanics and machines that are ready to carry on unlimited business. All large employers complain that enough common laborers are not to be had, and that they are compelled to pay mechanic's high wages to inefficient for doing a fraction of what good labor should perform. Hundreds of thousands of men and women are anxious to escape the privations and burdens of foreign countries and will come here the moment their rulers and our rulers facilitate their immigration. Let us welcome and assist them.

Mechanical Removal of Snow from City Streets

North of the Ohio river, handling the snowfall in the city streets is one of the most important and difficult of municipal operation problems. As the traffic grows and particularly as the number of surface cars and automobiles increases, congestion increases and the problem becomes more acute, the costs become greater, and the damage and inconvenience due to slow or inefficient work are larger and larger every year.

When there were only horse-drawn vehicles, they were all placed on runners in snowy latitudes, the sidewalks were more or less thoroughly cleaned and no great difficulty ensued. In 1885 or later, no less than four different types of vehicles were regularly operated by the street railway company in Montreal, which in summer ran open cars, in the fall closed cars, in the winter closed cars on runners, and in the spring, when the snow two or three feet deep softened and melted, they used large stages on very high wheels drawn with great difficulty by four horses. Little attempt was made to remove the snow which was shoveled from the sidewalks into the middle of the street, until late in the spring when it became very soft and in a few of the narrowest and most congested business streets a portion of the snow was shoveled into trucks or sleighs, hauled to the river, and dumped.

With the adoption of electric street cars, it became necessary to keep the tracks at least free of snow. This is accomplished in most northern cities of this country either by moving it to one side in heaps along the curb, or by removing it entirely, or by a combination of both methods. In some of the larger cities attempts are made to remove the snow entirely from main thoroughfares, after which in some cities, as in New York, attempts are

made to continue its removal from the principal resident streets and cross streets, the latter never being cleared very promptly and often not at all if the snows are frequent or if there are serious labor troubles.

Few if any large cities have adequate snow removing machinery and some have little or none, so that in any event they must depend in emergency, when work should be done rapidly, on private contractors and individuals, thus necessitating a large force of supervisors and accountants and opening the way for high prices, poor work and dishonest practices, some of which it is very difficult to detect or prevent. In the larger cities it is quite impossible to secure enough men and trucks to shovel and haul the snow with anything like the proper rapidity, it is difficult to get satisfactory dumping grounds and the unorganized units are quite likely to get in each other's way.

Many attempts have been made to supplement hand work by various methods such as melting by steam, hot water or even by flame, by flushing the snow into the sewers, and by sweeping, shoveling and elevating and hauling it by machinery. Very promising results were obtained by a new machine put in operation in New York last winter with results described on page 396 and attention is strongly called to the subject by the Women's Municipal League as noted on page 395.

Last winter the city of New York paid snow shovelers a flat rate of 50 cents per hour for very indifferent work by aged men, boys and lazy employes, many of whom evidently did as little as they could. Although they were inefficient and inadequate, trouble occurred with strikes and threats of strikes for increased pay, and even at that there could not be obtained enough men or vehicles, the work was very slow, and the city in the disgraceful condition throughout a large part of the winter, even though the huge sum of \$6,000,000 was paid to remove the snow.

Similar conditions may at any time be expected in all of our large cities and a knowledge of them should be more than sufficient to impress the public with the necessity of adopting a satisfactory system of snow removal, making a permanent organization for it and equipping it with abundance of the best mechanical installation that can be procured to do the work efficiently and eliminate the greatest possible amount of hand labor. The equipment should be selected or designed with a view to its full utilization for handling dirt, street sweepings, garbage and ashes the year around, and snow in winter. Different types of machinery should be studied by experts, who would modify it if necessary, and appropriations and authority provided immediately for preparation to be made during the summer adequate to handle the situation satisfactorily next year.

The installation of incinerators in apartment houses, hotels and private homes by property owners if they so desire has been taken under consideration by the Public Utilities Committee of the Board of Supervisors of San Francisco. The constantly increasing prices for the public disposal of garbage is the reason for this move.

Highway Maintenance in Essex County, N. J.

During the past five years bituminous concrete pavements have been laid by county forces at about \$1.30 a square yard. They are not suitable for steep grades. Their edges should be protected with broken stone shoulders.

In his report for the year 1919, Frederic A. Reimer, county engineer of Essex County, New Jersey, gives a brief statement of the general methods employed in the repairing and maintenance of the county roads in that county. Omitting references to local conditions and specific roads, this statement is as follows:

For the past five years the county has followed a policy of resurfacing a considerable mileage of the county highways each year with materials purchased under contract and laid by its own forces. The materials purchased under contract have been Type R, Amiesite and Warrenite. Type R and Amiesite have been used quite extensively and with excellent results. Taken over the entire period in which these materials have been used, the average cost per square yard of the material furnished and laid has been practically \$1.30 for both materials. On none of the roads which have been laid with this material has there been any necessity for making restorations, with the exception of where cuts have been made in the pavement, and on Northfield road where the edges of the pavement were improperly protected, which caused a rapid deterioration and necessitated considerable repairs this year.

The laying of this material, however, on the mountain roads having excessive grades should not be continued under any condition. Roads of this character require special treatment, and it is improper to lay bituminous materials on these long, steep grades.

There is remaining in the county system today fifty-three miles of the Telford macadam type which must be maintained at as reasonable a cost as possible, and the greater portion of this mileage can be maintained, on account of the small tonnage of traffic using same, by the ordinary stone repairs and road oiling.

With the large mileage of hard surface roads in the county system at the present time, the patrol system should be reorganized to meet these new conditions, and the sections patrolled be lengthened considerably in many cases. The work of the patrolmen over the sections now improved is practically confined to observation of the condition of the pavement and reporting any unusual deterioration which may occasionally occur. There is no reason, therefore, why the patrolmen should not, at all times, keep the shoulders of the road and the gutters entirely free of vegetation or other material which, if allowed to accumulate, is one of the first reasons why the pavements disintegrate along the

edges. On the other hand, on the old telford macadam roads, the patrolmen have the double duty of keeping the surface in repair, and also the shoulders and gutters clear of all foreign matter. These sections should be shortened in some cases, so as to assure the pavement being in repair at all times.

In a number of cases where the hard surface roads have been laid in the western section of the county, the edges of the pavement require that they be protected with a shoulder of broken stone, and I recommend that in all such cases this precaution be taken at the earliest possible date.

Wherever steep grades exist on these old pavements, it is an economic waste of labor and material to spread stone screenings over these road surfaces. This material is almost immediately thrown on to the shoulders and into the gutters by vehicles or storms and is carried away in the rush of water into the several culverts along these streets.

Bids for Toledo's Garbage

Five bids for the disposal of Toledo's garbage were received by service director Goodwillie in the latter part of April. Four of the five bids contained offers for paying the city for the garbage. The fifth, from the Toledo Disposal Company, asked payment from the city.

The Toledo Disposal Company now takes care of the city's garbage and is paid \$5,875 per year for disposing of it after it has been delivered to their plant. In their new bid they ask 74 cents a ton if granted a 20-year contract and 89 cents a ton if granted a 10-year contract. They use the reduction method of disposal.

Two of the other four bids were for disposing of the garbage by means of hog feeding. One from the A. B. Caple Feeding Company of Toledo offered the city \$1.25 per ton for the garbage under a 10-year contract. Another from Harry Conley of Kalamazoo offered \$1.26 per ton under a five-year contract.

The Michigan & Ohio Nu-Fuel Co. in its bid proposes to take the garbage and all other combustible wastes, and offers to pay 75 cents per ton under a 20-year contract. This company employs the refuse to make fuel.

The Pan-American Feed Milling Co. offered to pay \$1 per ton. This concern would convert the garbage into a commercial food for live-stock.

No decision has been reached as to which bid will be accepted.

Hiawasse Hydroelectric Development

Court decisions are reported to insure the construction of \$10,000,000 hydro-electric developments of the Hiawasse river in North Carolina and Tennessee. W. V. M. Powellson, New York, engineer. The developments involve twenty-six miles of land and riparian rights, two 150-foot dams to be built. It is estimated that 60,000 h.p. will be obtainable by the development, to be transmitted for lighting and power purposes in Tennessee and North Carolina.

Los Angeles Sewer Pipe Specifications

Recently adopted specifications give requirements for clay and cement pipe identical in most respects. Sand-bearing pressure, hydrostatic and absorption tests are made of both. Sewer joint compounds are provided for, and test for tightness of completed sewer.

The city of Los Angeles has recently adopted specifications for constructing sewers which contain modifications of the requirements of previous specifications for both clay and cement sewer pipes. We are informed by W. T. Knowlton that the results of tests made by the Engineering Department of the city on sewer pipe used under previous specifications had been tabulated by him and used as a basis for deciding the details required by the new specifications.

The specifications for sewer pipe and for the testing of them are quite complete, and space can be found for only a summary of some of the more important points, without going into all details as to dimensions.

The thickness of shell required is given as $\frac{3}{4}$ inch for both clay and cement pipe 6 inches in diameter, and for 24-inch pipe, 2 inches for vitrified clay and $2\frac{1}{8}$ inches for cement. Depth of socket required is, for 6-inch pipe, 2 inches standard and $2\frac{1}{2}$ for "deep and wide socket" for both kinds of pipe, increasing to $3\frac{1}{2}$ -inch standard for clay and 3-inch standard for cement, with four inches for "deep and wide" sockets in both materials. The annular space required is the same for both kinds of pipe, being $\frac{3}{8}$ inch for 6, 8 and 10-inch standard and $\frac{1}{2}$ -inch for all larger sizes, and $\frac{3}{8}$ -inch for 6-inch to 18-inch and $\frac{1}{4}$ -inch for larger sizes with "deep and wide socket" pipe.

"The space between the circumference of the lower inside diameter of the socket and the spigot of the pipe placed in said socket shall be not less than $\frac{1}{2}$ the annular space."

PERMISSIBLE VARIATIONS AND IMPERFECTIONS.

For each kind of pipe there is given a table of permissible variations in dimensions, which variations are the same for both kinds. For 6-inch pipe the length may be $\frac{1}{2}$ -inch short for each foot of length, the socket may be $\frac{1}{4}$ -inch short, the thickness of shell may be $\frac{1}{16}$ -inch less; while in all, these may exceed the standard without limit. The inside diameter of the pipe must not vary more than $\frac{3}{16}$ -inch in either direction. For 24-inch pipe, these variations are $\frac{5}{8}$ -inch per foot of length, $\frac{1}{4}$ -inch in depth of socket, $\frac{1}{8}$ -inch in thickness of shell and $\frac{1}{2}$ -inch in inside diameter.

It is specified in the case of clay pipe that all pipes and specials must be free from injuries, cracks, checks, blisters, broken rims or other imperfections. As further defining this, a list of imperfections is given which would be considered cause for rejection. These include:

A single crack in the body of the pipe extending through the entire thickness, regardless of the extent of such crack.

A single fire crack which extends through one-half the thickness and over three inches long.

Two or more fire cracks in the body of the pipe of a less length than three inches and extending through one half of the thickness.

Any fire crack which is more than $\frac{1}{16}$ of an inch wide at its widest point.

Lumps, blisters or flakes on the interior surface of a pipe or special.

Two or more breaks in the socket or spigot, unless they can be placed in the upper half of the sewer.

When the bore or socket of the pipe varies from a true circle more than 3 per cent of its nominal diameter.

When a pipe or special designed to be straight exhibits a deviation from a straight line of more than $\frac{3}{8}$ of an inch.

A piece broken from the spigot end deeper than the socket or longer than one-third of the diameter of the pipe.

A piece broken from the bell end, if the fracture extends into the body of the pipe or is longer than one-third of the diameter of the pipe.

In the case of cement pipe, the imperfections which will give cause for rejection are the same as in the case of clay pipe, except that the word "fire" is omitted in referring to fire cracks, and the sentence referring to lumps, blisters or flakes is omitted.

TESTS OF PIPE.

For each pipe it is provided that three tests be made—sand bearing crushing test, hydrostatic pressure test and absorption test. The first and third of these tests are exactly the same for both clay and cement pipe, but the second, the hydrostatic test, varies slightly.

The crushing test is to be made by bedding the pipe in sand for one quarter of its circumference and applying the load on a bed of sand covering one quarter of the top of the circumference; the depth of bedding above and below the pipe at the thinnest point being one half the radius of the middle line of the shell. The general provisions for the details of this test are similar to those ordinarily provided for tests of this character—neither top nor bottom frame shall come in contact with the pipe, the top bearing plate shall not touch the frame and shall extend the total length of the pipe and

shall be rigid, the load shall be applied to the exact center of it by means of a spherical bearing or two rollers at right angles, and a load shall be applied until a specified minimum crushing strength has been reached (no additional pressure being required, but such may be applied for record purposes). The minimum crushing strength required for each kind of pipe, per lineal foot measured on the inside of the pipe from bottom of socket to spigot end, is 1,430 pounds for 6 and 8-inch pipe, 1,570 pounds for 10-inch, 1,710 for 12-inch, 1,960 for 15-inch, 2,200 for 18-inch, 2,590 for 21-inch and 3,070 for 24-inch.

In making the absorption test, the specimen is dried at a temperature of 230 to 260 degrees Fahrenheit and then immersed in water for 24 hours, removed, drained for one minute and weighed. The maximum absorption must not be more than 10 per cent, calculated as a percentage of the final dry weight.

In making the hydrostatic pressure test for clay pipe, when such pipe is subjected to an internal hydrostatic pressure of 10 pounds per square inch during a period of 3 minutes, the exterior surface of each specimen tested shall show no percolation, the term percolation meaning moisture that trickles or runs down the side of the pipe. In the case of cement pipe, the hydrostatic pressure of ten pounds shall be applied during a period of 5 minutes and the exterior surface of the pipe shall not show percolation which will cover a total area of 30 square inches at the end of the 5-minute period, nor shall the accumulated moisture on the exterior surface of the pipe run down the side of the pipe in such a quantity that, when collected, it shall amount to two or more cubic centimeters during the 5-minute period.

SEWER JOINTS.

There are some other features of the specifications which are out of the ordinary. For instance, provisions is made for a sewer-joint compound to be used where specified, it being provided that the compound shall be such that, when heated to not less than 250 degrees F. and poured, it will adhere firmly to the surface of a dry pipe, or, when heated to not less than 350 degrees F., will adhere firmly to the surface of a pipe even though it be submerged in water below the springing line of the pipe. The flexibility of the compound shall be such that, after a pipe joint has been run and cooled, the pipe may be deflected at least five degrees from line or grade, and the compound in the joint show no signs of cracking, checking or breaking away from the surface. The melting point shall be not less than 70 degrees centigrade and the tensile strength at 25 degrees C. shall be not less than 175 pounds and at 40 degrees not less than 100 pounds per square inch. A piece of the compound $\frac{1}{8}$ inch thick and one-inch square, if submerged for 30 days in sea water, or crude sewage, a 5 per cent solution of caustic potash, a 5 per cent solution of ammonia, or a mixture of 5 per cent hydrochloric acid and 5 per cent sulphuric acid, shall, when subjected to the above tensile test, show a strength at 25 degrees of not less than 95 per cent of the untreated material.

In making a joint with this compound, the in-

ner surface of the socket and the spigot are painted with the compound. A gasket of dry oakum twisted into strands is tightly driven into the joint with a caulking iron, leaving a clear space of from one-inch to one and one-half inches between the gasket of the outer end of the socket. A greased runner is then placed around the pipe with the pouring opening on the top slightly off center, and the joint space is then completely filled by pouring into it the pipe-joint compound at a temperature of not less than 250 degrees F., the runner being left on for at least 15 minutes after pouring. If desired, pipes may be jointed in pairs on the bank by standing the two pipes on end and filling the bell of the bottom one, in which case no runner is required.

When ever pipe sewer is located within 10 feet of any trees which are to be left in, the joints of the pipes are to be entirely surrounded with four inches of cement concrete, mixed 1 cement, 3 sand and 6 broken stone or gravel.

In the case of wet soil, on the completion of each section of sewer between man-holes, the end of the sewer at the upper man-hole is to be closed to prevent the entrance of water from above, and if water is then found to enter the sewer from the trench in such quantities as to impair its efficiency, the leaks must be located and stopped. (Presumably no provision is made for damming up the ground water in the section being tested. The editor has applied the more rigid test secured by damming up the trench at the lower man-hole and permitting it to fill with water up to the ground water level, all joints to remain tight under the hydrostatic head thus created.)

CONCRETE.

In the specifications for concrete, a limit is placed on the amount of water which may be used, this being 50 pounds of water per sack of cement for 1:1½:3 concrete, 65 pounds per sack of cement for 1:2.4:4 concrete and 90 pounds for 1:3:6 concrete, a sack of cement being taken as one cubic foot. "The amount of water specified includes water already in the concrete materials, and in measuring water, allowance shall be made for water contained in said materials."

It is provided that the concrete mixer drum have a speed of not less than thirteen revolutions a minute and that the concrete shall be mixed in the drum for not less than 60 seconds before any portion of the batch is discharged from the drum, and at least 75 seconds must elapse between the placing of successive batches in the mixer.

Akron's Garbage Reduction Plant Abandoned

Akron, Ohio, has discarded its garbage disposal plant in favor of a new hog farm. This will bring to normal the collection of garbage which, due to the city's inability to get coal to operate the garbage reduction machinery, had been curtailed at least ten tons a day.

Under the new system the garbage is hauled by the city to the hog farm, which is independently owned, and is purchased there. Four thousand hogs will be kept at the farm.

The apparatus at the present garbage plant will

be sold. Approximately \$30,000 was invested in the equipment. It has been suggested that the building be turned into a rubbish and salvage plant.

Street Cleaning and Paving in Savannah

The city of Savannah has recently purchased for cleaning road and streets, two Elgin pick-up sweepers and one gutter cleaner, which are just being put into service for cleaning the streets in the city. The amount of paved streets will be increased this year by 140,000 square yards of new paving, contract having been let last fall for this amount of "vibrolithic," which will cost about \$550,000, and construction on which is to begin on May first. This pavement was adopted after an investigation

by the city commissioners of a similar pavement used in Jacksonville.

In addition, there is to be laid this year 100,000 square yards, the kind of which has not yet been decided. Considerable asphalt block has been used in Savannah, but we were informed in this city and also in Jacksonville that these blocks were now difficult to obtain, and probably none of that kind of paving will be laid this year. Two-inch Topeka top on 5-inch concrete base has been quite popular in Savannah. Although a few years ago asphalt block and some other classes of pavement were laid without concrete base on the loamy sand which is found throughout the city and which was thoroughly compacted for a foundation, no pavements are now being laid without concrete base.

Hudson River Vehicular Tunnel

By John F. O'Rourke.

The writer explains the nature of the clay in the bed of the river as he found it in building tunnels therein, and the proposed method of replacing soft material by depositing clay from above; also the concrete block method of construction.

The Hudson river vehicular tunnel has been under consideration for a number of years by two commissions representing the states of New York and New Jersey but the first definite plans were transmitted to the Legislature of the state of New York two years ago by the New York Commissioners. These plans showed a tunnel 42-feet in diameter constructed of concrete blocks at an estimated cost of \$12,000,000, exclusive of real estate, engineering, etc. At that time a bill was passed making a provisional appropriation of \$1,000,000 and a similar appropriation was made by the state of New Jersey, and under the terms of those two bills the commissions organized an engineering and legal department for future study of the proposed tunnel.

PLANS AND ESTIMATES.

On December 31, 1919, the chief engineer of the commissions, with the approval of a board of four consulting engineers, submitted plans for twin cast-iron tunnels 25 feet 6 inches inner diameter with a cast iron and concrete lining 1 foot 9 inches in thickness. This report condemned the concrete block tunnel plan already approved, and declared that two-line traffic roadways in the tunnels were ample to accommodate the traffic for many years to come. The estimated cost of these tunnels, including equipment, was \$22,967,000, exclusive of real estate, engineering, etc.

The writer prepared plans for twin tunnels of the same inner diameter, roadways and sidewalk, lined with concrete blocks 2 feet 9 inches in thickness. His estimate for this tunnel, including the same items, and based on many years' experience in such work, was \$15,540,000. Using the same item costs where they applied in common to both tun-

nels, he made the cost of the cast iron tunnels \$30,240,000; the cost in both cases being exclusive of real estate, engineering, etc.

He also submitted plans and estimates to the commissions for larger sized twin tunnels of concrete blocks 2 feet thick that would give a roadway of 25 feet for three lines of traffic, which would cost \$17,500,000. He further submitted another plan of larger diameter and same thickness of blocks containing a sidewalk similar to that in the cast iron tunnels and having a roadway 25 feet wide the cost of which was estimated at \$19,000,000. The cost in both cases was based on the same item costs as those on which the cast iron and concrete tubes of two line roadways and one sidewalk were based. These plans and estimates were submitted to the commissioners more than a month ago, but no effort has yet been made to explain the engineers' estimate, or refute the concrete block tunnel estimates, except some general assertions in an answer to criticisms of General Goethals. Neither have any details to show how the engineers arrived at their figures been given out.

HUDSON RIVER BOTTOM.

It is known to the writer and has been conclusively shown that the bed of the Hudson river is composed of clay banks similar in all respects from New York to Poughkeepsie to the clay banks along each shore. This was seen in constructing the Poughkeepsie bridge, where the original bed of the river, some 10 feet or 15 feet below the top of the mud, was firm and dry clay in layers which showed its sedimentary origin. At Haverstraw, where extensive cofferdams offshore enclosed clay pits, the excavations resembled in all respects similar clay pits adjoining the brickyards. In driving the Has-

kin brick tunnels by the pilot system under the North river from Jersey City, the same dryness and firmness was found. This is shown by the fact that $\frac{1}{8}$ -inch steel plates bolted together and braced by the pilot tube were sufficient to hold the clay at the top and sides for lengths of 2 feet to 15 feet of full size tunnel before building the brickwork, and also in the bottom where the brickwork of the invert was laid on the bare ground.

A striking example of just how dry and firm the ground was in these tunnels is shown in the use of the excavation for embankments, filling the tunnels to the springing line, on which were laid the construction tracks. The writer saw these tracks in use and the mules which pulled the cars used the embankment without planking, which could not be done if the clay were soft.

He also examined the clay in front of the shields in these same tunnels when they were being driven in part rock with cast iron lining. It was in horizontal layers and sufficiently firm to permit of stripping the layers like sheets from a pad.

In the Pennsylvania tunnels similar conditions existed. The writer, who was president and chief engineer of the O'Rourke Engineering Construction Co., which built these tunnels, became very familiar during their construction with the character of the river bed. In passing under the Fowler warehouse and the bulkhead on the Weehawken side of the river, piles were encountered that extended down to below the bottom of the shield. This clay was cut out vertically for the full height of the shields about 3 feet in front of them, and back to the piles, which were then sawed into convenient lengths for removal. The character and consistency of the clay was the same as in the Haskin tunnels and no sheeting or bracing was found necessary to maintain the face of the clay.

Afterwards in driving these tunnels across the river a certain amount of clay was admitted through the shields during each shove. This clay was also firm and dry. Numerous photographs taken while the work was in progress show this, and also that the clay flaked at the end of the "sausages" in layer formations. These layers, as seen in the pictures, show at different angles due to the fact that the layers outside the shield were bent from their horizontal position from all directions towards the opening through which they were forced into the tunnel at ten times the velocity with which the shield itself was shoved forward.

This behavior of the clay was uniform, as was also its always being found in layers, which shows that none of the clay which entered the tunnels through the shields was a viscous fluid, and that the shields were able to displace stiff clay, and not the reverse—that because the clay was displaced by the shields it must be viscous. All claims of viscosity in connection with this original Hudson river bed are as baseless as the other theories for which it is put forward as proof.

All the talk about encountering soft ground in constructing the proposed vehicular tunnel is opposed to the facts as known in regard to the original undisturbed river bed, and to what recent experience in the East river tunnels has demonstrated in regard to displacing soft ground with heavy clay blankets when it is found at depths that would give trouble if allowed to remain without treatment.

During the construction of the East river tun-

nels for the Public Service Commission, clay blankets were dumped across the tunnel lines wherever the cover was either insufficient in depth or soft in character, of heavy clay which itself was dredged from firm and dry clay banks in the Hudson river and New York bay. This clay invariably pushed the soft material aside and came to a bearing on the hard material, so that even in cases where the tunnel itself was above the bed of the river, the subsequent tunneling was done through these clay blankets with the same ease as if they were original clay deposits.

Alleged "Hudson river conditions" would not exist along tunnel lines properly prepared in this way and the clay bed of the Hudson is an ideal material in which to drive shield tunnels when thus properly prepared. In this firm ground thus prepared, any kind of tunnel could be readily driven, either cast iron, concrete blocks, or brickwork, and any statements to the contrary plainly blink the facts or show the ignorance of those who make them.

The reason for laying so much stress on the character of the river bed is to contradict the statements made in the discussions and to show that it lends itself most favorably to any kind of shield tunnel construction, and not because it is particularly desirable for concrete blocks more than for cast iron.

The principal difficulties in building shield tunnels across the Hudson river will be found in the approaches, as was seen in connection with the Pennsylvania tunnels, where two or three times greater speed was attained in the river. In those tunnels the only tie rods or bracing required was in the hard ground inshore, none being used in the clay of the riverbed. The cast iron lining stood without concrete for more than two years in those tunnels without deformation, other than the $1\frac{1}{2}$ -inch shortening of the horizontal diameter which returned to equality with the vertical without assistance.

The soft clay that was found outside the lining, but not at the front of the shields, was due to the water filling the space outside the lining that was exhausted from the hydraulic jacks and also to that squeezed by their great pressure from the clay in front of the shields. This water softened the clay and caused many to think that the clay itself was soft at the sides, which could not be true since it was hard at the face, and was also found to be hard once more at the time the experimental screw piles and the plugs covering the screw pile sections every 15 feet were removed at the time the tunnels were lined with concrete.

CONCRETE BLOCKS WELL ESTABLISHED.

There seems to be an impression that concrete blocks are a new idea in tunneling and that cast iron has been used exclusively. In New York it is true that cast iron has been used exclusively, excepting about two or three thousand feet of brick tunnel that was built by Col. Haskins in the North river, so that engineers whose tunnel experience has been confined to New York seem to look on concrete blocks or other masonry as something experimental for tunnels. About 25 years ago, following the example of the Haskin tunnels, an intake tunnel $1\frac{1}{2}$ miles in length was built from Cleveland out into Lake Erie, under conditions almost identical with the Haskin tunnels. About eight years ago

another tunnel three miles in length was built at the same place out into Lake Erie of concrete blocks by the shield method. This tunnel was very successful and on some days a progress of 40 feet was made. At this same time a concrete block railway tunnel was built under the streets of Montreal where the loading is greater than can happen in the Hudson. At Detroit the city authorities have been building brick tunnels for drainage in many places.

DETROIT TUNNELS.

Last year the Ford Motor Co. built a tunnel at Detroit 16 feet in diameter and 5,500 feet long, of concrete blocks in soft clay in six months. The situation at Detroit as regards the hard and soft ground is the opposite of that found in the Hudson, because the soft, amorphous material is generally found under about 30 feet of firm, dry, sedimentary deposit, in which many of the conditions of viscosity erroneously assumed for the Hudson, really exist.

Because of this peculiar soft ground condition, much consideration was given to various plans, but cast iron was finally rejected and the interlocking concrete block tunnel was selected instead. It is now completed and in use and the Ford engineers are very proud of their tunnel. The rings were always in compression and remained truly circular without bracing, as in the Hudson tunnels, under the river.

The engineers of the city of Detroit were so pleased with this tunnel that they permitted concrete block tunnels in general to compete with those of brick and monolithic concrete, the result of which is that the O'Rourke Company has contracts for two such tunnels, which will be completed this year. One of them is 16 feet 8 inches in diameter and 10,000 feet long, and the other 13 feet 2 inches in diameter and 6,000 feet long. A third tunnel is now planned, 6,465 feet in length, to go under some of the principal streets. The advertisement says that "materials allowed are brick or concrete segment blocks," so that whoever makes the best proposition for that tunnel will get the contract, whether the method is a patented one or not, if the other conditions are satisfactory, just as was done in the case of the Joy Road and Six Mile Road tunnels already described.

There is also to be built in Flushing this summer a small tunnel of concrete blocks, so that New York engineers who are unfamiliar with concrete block tunnels and some who "cannot conceive" how they are built will have a convenient opportunity to make their acquaintance.

COMPARATIVE ADVANTAGES OF CONCRETE AND CAST IRON.

There is no intention of minimizing the value of cast iron lined tunnels. They answer their purpose very well, but they suffer from two faults that are radically bad. First, they cost twice as much as concrete block tunnels, and next, they take twice as long to build. After the tunnel has been driven it must be lined with concrete, and experience has shown that this takes as long as the driving of the tunnel itself. The concrete blocks, on the contrary,

can be driven with at least as good speed as the cast iron tunnels and are finished up as they are erected. The methods of moulding the concrete blocks and erecting the rings have been developed to such accuracy that the inside surface of the concrete block tunnel can be kept as true to line and grade as the inside surface of the concrete lining of the cast iron tunnels has been kept heretofore and kept of uniform thickness as was not done in that case.

So far as bolting concrete blocks to make a connected structure, both as to rings and tube, is concerned, it can be done in a stronger manner than is possible with cast iron, where the bolts only connect the flanges of the plates together and are limited to the strength of the flanges instead of that of the bolts as in concrete blocks.

The method of waterproofing the joints in the concrete is also as reliable as the caulking of the cast iron tunnels, with the additional security offered by the grouting, which of itself always becomes watertight by the leaks soon "silting up," as is shown in the numerous deep cellars built of concrete caissons with four floors below water.

The statement that a concrete block tunnel is composed of loose blocks is reckless and irresponsible. The plans are perfectly clear as to the bolting, grouting and waterproofing, and to anyone who is familiar with the erection and finishing of concrete tunnels the efforts to condemn them in favor of something costing twice as much seems very unreasonable.

The further assertion that the joints in the concrete block tunnel would open because of the absurd assumptions in regard to the strains it would have to undergo and that the water would enter the joints and disintegrate the blocks shows ignorance of the long experience the city has had with its precast concrete block bulkhead walls. The greater part of the New York waterfront is lined with these walls and wherever built of that material it is in first class condition today, although exposed to polluted salt water containing all kinds of destructive ingredients, an exposure much greater than would be possible in connection with a concrete block tunnel.

The writer inquired recently of a distinguished engineer under whom a large part of this bulkhead wall was constructed, as to his views in regard to the action of salt water on precast concrete. He writes:

In reply to your letter of the 29th inst., I have to say that in my experience of nearly a quarter of a century in using concrete blocks (precast) in the waters of our harbor, that I have not known or heard of any damage to them by action of the harbor water below low tide mark.

It is evident, then, that the tunnel line is, or can be made, dry, firm clay to the required distance above the tunnel or tunnels; that the cast iron tunnels cost more than estimated and twice as much as concrete block tunnels; that the concrete block tunnels are shown by experience to have the required strength, durability, watertightness and facility of construction, and that, therefore, it seems that to incur the extra cost and time required for cast iron tunnels is entirely unwarranted.

Recent Legal Decisions

Awards of Public Construction Work to Lowest Bidder.

The Pennsylvania Supreme Court holds that the Act of July 6, 1917 (P. L. 752), authorizing municipalities to provide by ordinance or contract that any part or all of work on public buildings should be done within municipal limits is a special act violating the State Constitution, art. 3, 97, forbidding special legislation regulating labor or trade.

It is also held that an ordinance of the city of Philadelphia, requiring contracts for the construction of public buildings to specify the obligation of departments to have stone cutting done in the city and that proposals shall so specify, violates Act of May 23, 187 (P. L. 230), requiring all work and materials furnished to the city under contracts to be let to the lowest responsible bidder. This is the first time the right of a municipality to require work to be done within the city limits has been directly passed upon by the appellate courts of Pennsylvania, and the decisions of other states are not in harmony; their general trend, however, is to hold such requirement invalid where its tendency is to conflict with statutory provisions requiring contracts to be let to the lowest responsible bidder.—*Taylor v. Philadelphia*, Pennsylvania Supreme Court, 104 Atl. 766.

Construction Contracts—Careening of Pier.

In a county's action against a bridge contractor for damages because of the careening of a pier, the Kentucky Court of Appeals, *Pregoria Bridge Co. v. Floyd County*, 205 S. W. 690, held that, where the bridge was constructed in a workmanlike manner and the foundation upon which the concrete base of the pier was placed was agreed to by the county, the contractor was not liable for damages because of the careening of the pier, where it would have been strong enough except for diversion of water due to the accumulation of logs, which the county could have prevented. Where neither the specifications nor the blue-print plans indicated the depth of excavation for the concrete foundation, it was competent for the parties to the building contract to agree in regard thereto.

Recovery for Excavation Work.

A contractor for excavation work, who early discovered false representations as to the character of the work, might then have repudiated the contract and recovered the fair value of the work done and material finished. It has been held (*Sharp v. Mayor*, 40 Barb. N. Y. 256) that a municipality may be charged with responsibility for misrepresentation which have been made by its agent to induce a person to enter into a contract with it.—*Prest v. Farmington (Me.)*, 104 Atl. 521.

Inaccurate Final Estimate.

The West Virginia Supreme Court of Appeals holds that, though a railroad construction contract provides that the chief engineer of the railroad com-

pany, before the payment of the final estimate, may require of the contractor "apt and proper release of all liens of laborers, materialmen, subcontractors, and others for any work done upon or material or supplies furnished for the work embraced in the contract," nevertheless, if the conduct of such engineer in preparing the estimate was fraudulent, or if he was guilty of an inaccuracy so gross as to imply bad faith or a failure to exercise an honest judgment, the contractor is not bound by such estimate and need not tender such releases, but may maintain an action on the contract to recover the true amount due him.—*Vaughan Const. Co. v. Virginian Ry Co. (W. Va.)*, 97 S. E. 278.

Rights of Subcontractors.

In an action against the principal contractor for sewerage and pipe-laying in the streets of a town, the town, and the surety company for the faithful performance of the contractors contract, the North Carolina Supreme Court holds *Schefflow v. Pierce (N. Car.)*, 97 S. E. 167, that a subcontractor of the sewer work, on the failure of the principal to pay for work done, may recover on the principal's bond, given pursuant to Laws 1913, c. 150, as amended, requiring a bond conditioned for the payment of all labor done. The contract of the principal contractor with the city being to do that very work, and the contract with the surety company, being that he shall faithfully perform all the provisions of his contract, which included this very trenching which the plaintiff had done, and which the principal contractor contracted to "furnish at his own expense," it followed that the plaintiff was entitled to sue as beneficiary under the contract, and to recover of the surety company the balance due by the principal contractor for the execution of such work by the plaintiff.

Contractors' Bonds—Discharge of Surety.

The California Supreme Court holds that tubing at the end of which was attached a knife, used solely as an appliance in perforating the casing of a well, which the contractor retained unimpaired save for wear and tear, was not within the California Statute of 1897, relating to bonds on public improvements, and requiring a bond to pay for material and supplies furnished "for the performance of the work." Rental and transportation of tools used, however, are within the statute.

A materialman on a city contract, before filing any against the city for labor or material, gave the city written notice that it released the city from all claimed and authorized payment to the contractor. It is held that this notice was of no effect, there being no enforceable claims to release until claims were filed; and hence the notice did not affect the liability to the materialman of the surety on the contractor's bond.—*Sherman v. American Surety Co. (Cal.)*, 173 Pac. 161.

NEWS OF THE SOCIETIES

May 10-11.—AMERICAN ASSOCIATION OF ENGINEERS. Sixth Annual Convention, St. Louis, Mo. Secretary, C. E. Drayer, 63 East Adams Street, Chicago.

May 13-14-15.—LEAGUE OF TEXAS MUNICIPALITIES. The eighth annual convention will be held at Dallas, Tex. Secretary-Treasurer, Frank M. Stewart, University of Texas, Austin, Texas.

May 18-21.—NATIONAL ELECTRIC LIGHT ASSOCIATION. Annual convention, Pasadena, Cal. Acting Secretary, S. A. Sewall, 29 West 39th Street, New York City.

May 19-21.—INDUSTRIAL RELATIONS ASSOCIATION OF AMERICA. Auditorium Theatre, Chicago.

May 24-26.—NEW JERSEY STATE BUILDING TRADES COUNCIL. Atlantic City, N. J.

June 16-18.—NORTH CAROLINA GOOD ROADS ASSOCIATION. Annual Convention, Asheville, N. C.

June 21-25.—AMERICAN WATER WORKS ASSOCIATION. Annual meeting, Montreal, Canada. Secretary, John M. Diven, 153 West 71st Street, New York City.

June 22-25.—AMERICAN SOCIETY FOR TESTING MATERIALS; Asbury Park, N. J. Office of secretary, Philadelphia.

June 22.—JOINT COMMITTEE ON STANDARD SPECIFICATIONS FOR CONCRETE AND REINFORCED CONCRETE. Next meeting at Asbury Park. Secretary-treasurer, D. A. Abrams, Lewis Institute, Chicago.

Aug. 30-Sept. 3.—AMERICAN PUBLIC HEALTH ASSOCIATION; San Francisco. Office of secretary, Boston.

Oct. 12-14.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, St. Louis, Mo. Secretary, Charles Carroll Brown, 404 Lincoln Avenue, Valparaiso, Ind.

CHICAGO BUILDERS ASSOCIATION

For several weeks this association has been in almost daily conference at the request of the Building Trades Council, with bankers, material men, architects, real estate dealers, and contractors to prepare agreement for readjustment of wage rates. It was agreed that conditions do not warrant any increase in wages and the contractors and Chicago Building Trades Council recorded their opposition to the incessant strikes, their determination to have all jurisdictional disputes settled by the local joint conference board subject to the appeal of the National Board for jurisdictional awards.

MISSISSIPPI VALLEY ASSOCIATION

The Mississippi Valley Association, organized last year to direct the public policy of the 22 Mississippi Valley states that constitute 53 per cent of the voting power of Congress, met in convention in St. Louis, April 20 and 21, with an attendance of 350 delegates from 49 different cities in 19 of the Mississippi Valley states. The program was joined to that of the Mississippi

Valley Water Ways Association, whose convention preceded this one by one day, and was addressed by a number of eminent men including Major General Lansing H. Beach, chief of engineers of the United States Army; Brigadier General Frank T. Hines, chief of transportation of the United States Army, and being in charge of the Mississippi Warrior Waterways; Joshua W. Alexander, secretary of commerce, the governors of Louisiana and of Arkansas and several other prominent men.

Discussing foreign labor and social unrest, Governor M. Parker of Louisiana stated that socialism is due primarily to low classes of foreign labor that have not assimilated American ideals, and that they must be taught or be shown that any man who seeks to destroy property shall be regarded not as a laboring man, but as a criminal, and treated as such, and that when any laboring man is elected to public office in the United States, he should be compelled to take out a withdrawal card from his union and cease to be a union man until his period of office holding expires. Resolutions were adopted calling for Federal legislation to make strikes and lock-outs in public utilities and the essential industries unlawful.

H. H. Merrick, president of the Great Lakes Trust Company, Chicago, was re-elected president; J. B. Morrow of Cincinnati was chosen executive secretary and James E. Smith, vice-president in charge of waterways. A combination was effected between this association and the Mississippi Valley Waterways Association and New Orleans was chosen for the convention in 1921.

THE NATIONAL CIVIC FEDERATION

The twentieth annual meeting of the National Civic Federation at Hotel Astor, New York, was presided over by Judge Alton B. Parker, and among the subjects presented were: Increased Production through Industrial Training, Arbitration Conciliation and Collective Bargaining, Compulsory Sickness Insurance, and Workmen's Compensation-Occupational Disease, all of which were presented and discussed by very prominent men including Jeremiah W. Jenks of the Alexander Hamilton Institute, Louis B. Schram, chairman of the Industrial Accident Prevention Department, The National Civic Federation, Ralph M. Easley, chairman of the executive council

of the National Civic Federation, Allen Walker, Foreign Department of the Guaranty Trust Company, Hugh Frayne, general organizer of American Federation of Labor, Dr. Frederick L. Hoffman, Samuel Gompers, president of the American Federation of Labor, Timothy Shea, president of the Brotherhood of Locomotive Firemen and Engineers, and others.

CHAMBER OF COMMERCE OF THE UNITED STATES

Increased production and economy in expenditures were put forward by the Chamber of Commerce of the United States in its eighth annual meeting at Atlantic City as a solution of many of the country's industrial and social problems. A national program of increased production was drawn up by more than three thousand business men attending and was put forward in a series of resolutions.

Joseph H. Defrees, of Chicago, formerly vice-president and chairman of the executive committee of the chamber, and at one time president of the Chicago Association of Commerce, was named to head the institution in the place of Homer L. Ferguson, of Newport News, Va., who retired after a one year term.

Among the resolutions of the meeting, which was called an "Increased Production Convention," were those declaring that:

The country's problems can be largely solved through increased production and economy must be practiced by public authorities and by every citizen.

A treaty of peace should be put into effect without more delay.

The government should refrain from entering any field of business where it can be conducted by private enterprise.

American ideals should be maintained.

Railroad transportation facilities should be built up.

Adequate appropriation should be made for development of waterways.

The traction situation should be improved.

Pivotal industries should be protected.

ILLINOIS GAS ASSOCIATION

At the convention of the Illinois Gas Association, Chicago, March 17, the officers elected were W. M. Willett, president; H. H. Clark, vice-president; and R. V. Prather, secretary-treasurer. Among the subjects considered were public relations, research fellowship, heating by gas and electricity, industrial uses, appraisals and rate of return for utilities, consumption and rate, operating expenses.

New Appliances

Versatile Locomotive Cranes.

Locomotive cranes manufactured by the United States Crane Company are equipped with tapered latticed steel booms up to 55 feet long, that can be operated either with ordinary hoisting tackles suitable for general loading, unloading, transporting and construction operations, or can be used with orangepeel or clamshell buckets for loading and unloading sand, gravel, broken stone, coal, or other loose materials, or even for dredging. They are also provided with powerful electro-magnets, enabling them to handle

Box Finder acts equally well through ice, snow, concrete, wood, earth or other solid substances and locates boxes that have been covered with earth or whose position has been forgotten. The Clark Wireless Pipe Locator, is useful to find pipes in any position and the Clark Surface Reservoir Gage for water works, can be placed in the engine house and connected so as to accurately indicate the depth of water in the reservoir at any distance from the gage even when the level of the water is below that of the gage.



CRANE EQUIPPED WITH CLAM SHELL BUCKET.

all kinds of iron and steel scrap, plates, castings and other products safely and rapidly without the delay, danger and expense of attaching hooks, slings, clamps or other mechanical devices. They have a maximum capacity of 20 tons and a locomotive speed of 600 feet per minute.

Testing and Trouble Finding Instruments.

Valuable instruments for water works departments are manufactured and sold by the H. W. Clark Company. They have put on the market the Clark Indicator, a watch-like instrument with a dial and index showing pressure up to 150 pounds that locates leaks in service pipes by the indicated loss of pressure they occasion. The use of this instrument may often be advantageously supplemented by the Clark Sonofone that locates small leaks in pipes by the sound and has a diaphragm connected to a sectional detecting rod, entirely free from contact throughout its length, that gives a distinct transmission of sound to the diaphragm.

The Clark Service Box and Valve

The Clark Meter Tester is completely equipped with adapters to fit every water meter of every manufacture even though of obsolete type and can test meters singly or simultaneously in multiples up to six.

Magnesia Association Specifications.

The Magnesia Association of America has issued specification A. A. for 85 per cent magnesia non-heat-conducting coverings for power and heating systems, compiled and endorsed by the Mellon Institute of Industrial Research, University of Pittsburgh, and adopted by the Magnesia Association of America, which is intended to supersede all previous specifications. The specifications apply to coverings for all exposed surfaces, all pipes, fittings, or appurtenances carrying steam, hot water or hot gases and carefully designates the materials, form and thickness of coverings for different portions of the plant and under different conditions, thus considerably facilitating the design, purchase and application of the protective material.

Kennedy Valve Mfg. Co.

The Kennedy Valve Manufacturing Company announces the appointment of C. H. Kennedy, M. E., formerly New York district manager, as general sales manager, with headquarters at the plant, Elmira, N. Y.

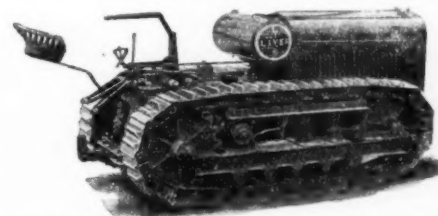
Mr. Kennedy's place in New York has been taken by J. S. Hanlon, formerly Boston representative, and George W. Waters, formerly in the sales department of the New York office, has been made Boston representative.

An additional sales office has been opened at 208 Mutual Building, Kansas City, with F. N. Decker in charge. Mr. Decker has for many years been connected with the plant at Elmira.

The Oliver Tractor.

This machine, manufactured by the Oliver Tractor Company, is especially designed to be operated independent of weather and soil conditions and has caterpillar traction with a bearing area of 1,320 square inches, reducing the unit load to about one-fifth of that of an ordinary man. It is especially efficient for plowing, for hauling all kinds of machinery, for operation on all kinds of soil, and for furnishing belt power.

It is equipped with a 100-pound four cylinder, four cycle, valve-in-head lever motor of 4½-inch bore and 6-inch stroke with a normal speed of 900 r. p. m., which uses gasoline or kerosene fuel. It has forward speeds of 1¼ and 2 1/3 miles per hour and reverse speed of 1¼ miles. The two manganese steel shoes are 11 inches wide and 60 inches long loaded to about 5



TRACTOR WITH SPECIAL LARGE AREA CATERPILLAR TREAD.

pounds per square inch. It is provided with transmission of the selective, sliding gear, live axle type, and all gears and pinions are of hardened steel, heat treated and enclosed in dust proof case containing oil bath. It can deliver 30 h. p. through a belt and 15 h. p. through the draw bar and weighs, boxed for export, 8,500 pounds.

INDUSTRIAL NOTES

Abstract of Bids.

This useful souvenir is being distributed among the paving contractors by the T. L. Smith Company, manufacturers of the Smith "Simplex" paving mixer and other items of contractors' equipment. It is a 4 $\frac{1}{4}$ x8-inch leather-bound booklet and contains a pad with sheets ruled for the contractor to keep a record of all the road bids entered on the various jobs. While sitting in on the "Contractors' Lettings," the contractor can record the figures entered by other bidders and he can keep this information for his future reference and guidance. The record pads are detachable and the company will gladly supply additional pads when the sheets are used up. The book is just pocket size and is fitted with a full-sized pencil.

The Champion Corporation.

The Champion Corporation announces that the former name, Champion Potato Machinery Company, has been changed to Champion Corporation, Hammond, Indiana, to better cover the diversity of their products which, besides various kinds of strictly agricultural machines, includes a sewer cleaning machine that is light, portable and efficient, does not require skilled operators and removes sand, gravel, rubbish, roots and other obstructions from sewers with rapidity and economy.

The Foundation Company, New York

The company announces that Edwin J. Beugler has been made vice-president in charge of engineering, and that Joseph H. O'Brien has been appointed chief engineer.

On and after May 10 the company's New York offices will be located in their own building at 120 Liberty Street.

Sullivan Machinery Company's Novel Publicity.

The Sullivan Machinery Company announces their entertainment as guests of hundreds of mining and engineering school students from all parts of the United States who are taken on trips to the company's plant in Claremont, N. H., and in Chicago to see the construction and operation of drills, coal cutters, quarrying machinery, air compressors and drill sharpener machines. Thousands of miners and engineers also will make the trip during the coming summer, in a mental way, through the presentation of the processes by moving picture films prepared especially for the purpose

and loaned to employers who desire to interest and educate their forces. One film is entitled, "Building, Mining and Quarrying Machinery at a Yankee Shop." The other film is called, "The Story of Coal" and is borrowed from the U. S. Bureau of Mines.

Sanitary Sewer Basin Co.

The Sanitary Sewer Basin Co. of Illinois, have opened offices at 549 W. Washington Boulevard, Chicago. They manufacture a patented all cast-iron sewer catch basin and an adjustable noiseless and lock cover patented manhole.

Carl E. Gschwind formerly in business in Youngstown, O., is a member of the firm. He has had many years of experience in the iron industry.

PROBLEMS CITIES ARE STUDYING WITH EXPERTS.

Chester & Fleming, engineers, Pittsburgh, have completed a survey of the water department of Memphis, Tenn., recommending the expenditure of \$1,000,000 for the improvement of the artesian pumping and WATER DISTRIBUTION SYSTEM and the construction of a new reservoir.

The city of Los Angeles, California, has created a CITY PLANNING commission of 51 members, from which will be selected an executive committee of 9 members. The commission will prepare and collect plans and suggestions for the various city departments and will classify and coordinate them.

PERSONALS

Knight, Harold, has been appointed regional engineer of the Erie Railroad with offices at Youngstown, Ohio.

Miller, J. J., a retired contractor and bridge and dock builder, died in Brooklyn, February 26th.

Norcross, Orlando W., one of the most prominent and able builders in New England, who for 50 years had been connected with much important building and construction work, died at Worcester, Mass., February 27th.

Salph, Dr. A. V., consulting civil engineer specializing in steel and concrete construction, died at Berkeley, Calif., February 13th.

Deleglise, Alexander, has been elected city engineer of Antigo, Wis.

Eichelberger, F. O., has been appointed director of public service system, Ohio.

Harrison, J. F., has been appointed director of public service system, Ohio.

Grupe, George, has been appointed city manager of Brownsville, Texas, salary \$5,000.

Rayburn, J. H., has been appointed city manager of Chadron, Nebraska, salary \$5,000.

Mason, Landon R., Jr., of Richmond, Va., has been appointed general manager of the Southern Willite Paving Co., Inc., Broadway National Bank Bldg., Richmond, Va. Mr. Mason spent over four years in the British Army in Gallipoli, Palestine, and on the Western Front, and on his transfer from the British Forces to the American Army in 1918 was Acting Major, Royal Engineers.

Bauer, Chas. F., of Jersey City, for many years with the Uvalde Asphalt Paving Co., has been appointed general manager, Willite Road Construction Co., of New Jersey, with offices at 51 Church street, New York.

Baldwin, A. S., has been elected vice-president in charge of Chicago's Terminal Improvements.

Miller, C. E., has been appointed chief engineer of the Belzoni Drainage District, Belzoni, Miss.

Cheatham, C. W., has been appointed senior highway engineer, Alaska.

Whited, Willis, has been appointed consulting engineer to the Pennsylvania State Highway Department.

Rumpelstin, S. S., has been appointed village engineer of Johnson City, New York.

Moritz, E. A., has been appointed project manager of the Flathead Project, St. Ignatius, Montana.

Giles, J. A., Binghamton, N. Y., has been appointed consulting engineer of Johnson City, New York.

Reeves, C. H., has been appointed superintendent of the department of public utilities, Seattle.

Culverhouse, H. C., has been appointed assistant engineer of the Alabama State Highway Department.

Smith, A. L., has been made division engineer of the Alabama State Highway Department.

Newell, H. F., for several years a member of the engineering staff of the Panama Canal Commission, died at Ancon, April 5.

Gorges, Major General W. G., has been appointed director of extensive sanitary work for the Peruvian government and has sailed from Peru for New York, Belgium and West Africa.

Campbell, G. A., has been appointed member of the Nevada State Department of Highways.

Ellis, J. R., has been made principal assistant engineer to W. L. Winter, civil and hydraulic engineer, Fort Smith, Ark.